THERMO ELECTRIC
ULTRAMITE
ULTRAMITE
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ULTRAMITE

OPERATION MANUAL

THERMO ELECTRIC INSTRUMENTS

ULTRAMITE OPERATION MANUAL

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1-0 DESCRIPTION

1-1 Introduction

This manual contains all the information normally required to operate and maintain the portable Ultramite digital indicator/calibrator. Always refer to the serial number and model number on the label attached to the case in correspondence, so that the unit can be properly identified.

Should you require additional information beyond what is contained in this manual, contact your local Thermo Electric Applications Engineer or our main office in Saddle Brook, New Jersey. For service information contact:

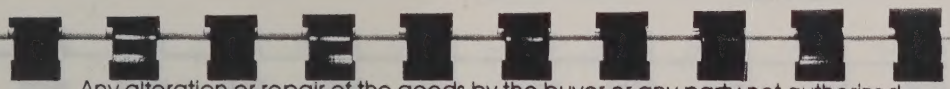
Thermo Electric Company, Inc.
109 Fifth Street
Saddle Brook, New Jersey 07662
ATTN: Instrument Service Manager
Phone: 201-843-5800

1-2 Warranty

Thermo Electric Co., Inc. warrants Ultramite to be free from all defects in material and workmanship for a period of two years, commencing on the date of shipment from Thermo Electric or one of our approved distributors.

The liability of the seller is limited to the repair or the replacement of the product only if failure occurs during the warranty period and factory inspection shows no external affects or customer repair altered the functioning of the instrument.

The instrument is to be returned to Thermo Electric or the nearest Thermo Electric authorized service center, freight prepaid, via the most economical service transportation methods after authorization by Thermo Electric. All charges for handling, reinstalling and miscellaneous expenses incurred will be the responsibility of the buyer. When factory examination shows the returned instrument to be within the above warranty period, the equipment will be repaired or replaced, at the seller's option at no charge to the buyer. This warranty shall be rendered null and void when, in the judgement of qualified Thermo Electric personnel, the equipment has been subject to abnormal or abusive use or lack of proper care or maintenance by the buyer, or when it has been determined that environmental conditions have exceeded those specified by Thermo Electric.



Any alteration or repair of the goods by the buyer or any party not authorized by Thermo Electric without our specific consent, in writing, shall automatically terminate our warranty obligation.

This warranty on instruments manufactured and/or sold by Thermo Electric, or on any service provided by us, is expressly in lieu of all other warranties, expressed or implied. No warranty is made of MERCHANTABILITY or fitness for any particular purpose.

No agent is authorized to assume any liability for it or to make any written or oral warranties or obligations beyond those set forth herein unless endorsed in writing and signed by an officer of Thermo Electric.

1-3 General Description

Ultramite is a highly accurate portable instrument which can be used to:

1. Measure temperature directly, using a thermocouple or RTD.
2. Measure millivolt, milliamp, and DC voltage signals directly.
3. Calibrate potentiometer type instruments.
4. Calibrate transmitters and a wide variety of process control instrumentation.

Ultramite is a multiple function instrument with built in reference junction compensation of thermocouple ranges. It includes the ability to indicate and output the full useable range of NBS thermocouple types J, K, T, E, R, S, and B. Additionally, 3 or 4 wire 100 ohm @ 0°C platinum RTD's to DIN Curve 43760 (Alpha 0.00385 ohms/ohm/°C) can be indicated. Ultramite also contains the

ability to input or output millivolts, milliamps, and DC voltage. When working with temperature, resolution is 0.1°F/C.

The Ultramite is available with a high resolution option which includes the following:

(1) Temperature resolution is 0.1°F/C, the same as with the Standard Ultramite.
(2) Resolution has been increased from 0.01 to 0.001 mV, mA and VDC.
(3) RTD readings have been changed from direct temperature to ohms, with a 0-700 ohm input range (18-500 ohm output range) and a resolution of 0.01 ohms. This permits the use of almost any type of RTD. Where required, the appropriate tables can be used to convert readings in ohms to temperature.
(4) A fixed decimal point and "OHMS" have been added to the display panel to facilitate readings in ohms.

Ultramite is powered by a rechargeable lead acid battery pack which provides up to 12 hours continuous operation. The battery pack should be charged by using the standard 115 VAC or 230 VAC line cord housed in the enclosure cover. Merely plug the line cord into the receptacle on the side of Ultramite.

1-4 Ultramite Specifications

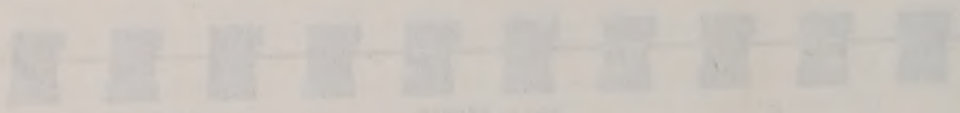
Thermocouple Input Mode Specifications

ISA Calibration	Range	Accuracy
J	−320 to 2000°F	±0.7°F
	−196 to 1094°C	±0.4°C
K	−310 to 2500°F	±0.9°F
	−190 to 1371°C	±0.5°C
T	−330 to 750°F	±0.8°F
	−201 to 398°C	±0.4°C
E	−320 to 1830°F	±0.9°F
	−196 to 999°C	±0.5°C
R	30 to 3200°F	±1.7°F
	−1 to 1760°C	±0.9°C
S	30 to 3200°F	±1.7°F
	−1 to 1760°C	±0.9°C
B	1000 to 3300°F	±1.8°F
	538 to 1815°C	±0.9°C
RTD	−320 to 1500°F	±0.7°F
	−196 to 816°C	±0.4°C

F or C membrane switch selectable from front panel.

Thermocouple Input Mode Specifications

Resolution	0.1°F or 0.1°C - all ranges.
Input Leakage Current	10 nanoamperes maximum.
Source Resistance Effects	1uV error/100 ohms source resistance.
Input Impedance	100 meg minimum.
Span Drift	25ppm/°C or reading.



Zero Drift	0.23 uV/°C.
Reference Junction Compensation Error	0.02 deg./deg. J,K,T,E calibrations. 0.05 deg./deg. R,S,B calibrations.

Thermocouple Output Source Mode Specifications

Range	All thermocouple ranges listed above.
Adjustment	Coarse and fine membrane switches continuous adjustment over entire span.
Source Mode	Compensating output thermocouple simulation.

Input Millivolt Mode Specifications

Range	−9.99 mV to 90.00 mV reading.
Accuracy	±0.01 mV.
Resolution	0.01 mV.
Input Leakage Current	1 uV error/100 ohms source resistance.
Input Impedance	100 megohms.
Span Drift	25 ppm/°C of reading.
Zero Drift	0.23 uV/°C.

Output Millivolt Mode Specifications

Range	−9.99 to 90 mV continuous adjustment.

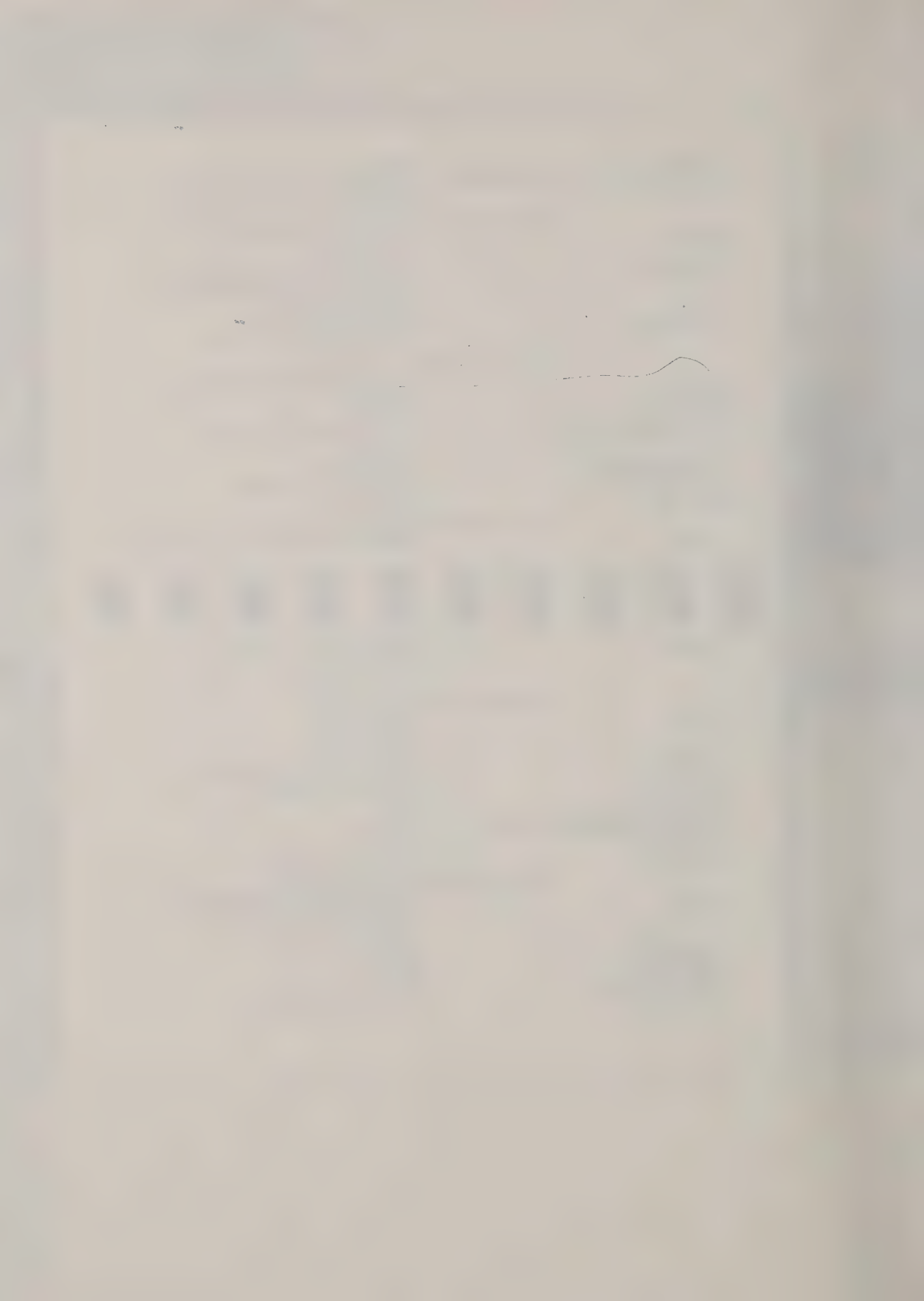
Adjustment	Coarse and fine membrane switches continuous adjustment over entire span.

RTD Input Mode Specifications

Range	−320 to 1500°F. −196 to 815°C.
Accuracy	±0.7°F or 0.4°C.
RTD Curve	Din standard 43760 .00385 Alpha.
Type Wiring	3 or 4 wire configuration.
Excitation Current	1 mA.
Maximum Compensation Lead Resistance	100 ohms.
Span Drift	25 ppm/°C of reading.

Milliamp Input Mode Specifications

Range	−9.99 to 90.00 mA (input-display). Unit displays "LO" below −9.99 mA, "HI" above 90.00 mA.
Accuracy	±0.01 mA.
Resolution	0.01 mA.
Shunt Resistance	10 ohms.
Span Drift	50 ppm/°C of reading.



Milliamp Output Mode Specificatons

Range	0 to 50 mA continuously adjustable. Unit displays "LO" below 0.00 mA, "HI" above 50.00 mA
Maximum Ouput Load Resistance	480 ohms @ 50 mA 1200 ohms @ 20 mA 4800 ohms @ 5 mA
Adjustment	Coarse and fine membrane switches continuous adjustment over entire span.

Voltage Input Mode Specifications

Range	−9.99 to 30.00 volts DC input display. Unit displays "LO" below −9.99VDC, "HI" above 30.00 VDC.
Accuracy	±0.01 volts.
Resolution	0.01 volts.
Input Impedance	10 megohms.
Span Drift	50 ppm/°C of reading.

Voltage Output Mode Specifications

Range	0 to 10 volts DC continuously adjustable. Unit displays "LO" below 0.00 volts, "HI" above 10.00 volts.
Maximum Load Resistance	1000 ohms

Adjustment	Coarse and fine membrane switches continuous adjustment over entire span.

General Specifications

Ambient Operating Temperature Storage Temperature	0°C to 55°C Ultramite: −50°C to 90°C Batteries: −40°C to 60°C
Normal Mode Rejection	50 db.
Common Mode Rejection	125 db, when operating on A/C voltage
Battery Pack	6 cell lead acid, rechargeable 2.5 amp hours, 12V nominal.
Battery Life	Normal input operation thermocouple or mV output: 10-12 hours continuous. mA or volts output: 4-6 hours continuous.
Battery Charger	Integral with unit, 115 or 230 VAC.
Battery Charge Time	8 hours 90% charge, 18 hours 100% charge.
Battery Discharge Indicator	Early warning-unit emits audible beep. Final warning-unit displays "HELP". Unit shuts off after 1 minute in "HELP".

Overrange	Unit displays "HI".
Underrange	Unit displays "LO".
Open Thermocouple	Unit displays " — — — — — — ".
Legend	Thermocouple or RTD: Unit displays "F" or "C". V or mV: Unit displays "E". mA: Unit displays "A".
Display	0.75" LCD 6 digit display (6th digit legend). Leading zeros blanked "-" sign left of leading digit.
Function Switching	Membrane with audible and visual feedback.
Membrane Switch Material	Polycarbonate/silver contacts.
Case Material	Rigid urethane UL 94VO high density.
Case Finish	Polyurethane paint.
Case Dimensions	12" wide x 10" high x 6.5" deep (including cover).
Weight	12.5 lbs. (including cover and line cord).

1-5 Order Code

Prior to operation check the order code. Ultramite with a 115 VAC battery recharge capability is specified by Model Number 31180.

Ultramite with a 230 VAC battery recharge capability is specified by Model Number 31181.

6th digit	0 Standard Ultramite (0.1°F/C, 0.01 mV, mA, VDC resolution & RTD reading in direct temperature
	1 High Resolution Ultramite (0.1°F/C, 0.001 mV, mA, VDC resolution & RTD readings in ohms, to 0.01 ohms
7th digit	0 standard depth lid.
	1 includes 1" deeper lid
8th digit	0 no carrying case
	1 includes carrying case
9th digit	0 no switch module
	1 includes 6 point switch module
	2 includes 12 point switch module
10th digit	0 no calibration certificate traceable to NBS
	1 includes calibration certificate traceable to NBS

2-0 INSTALLATION

2-1 Unpacking

Unpack the instrument immediately upon receipt and check for shipping damages. If damaged, immediately report the damages to the carrier. Replace the instrument in its shipping container until ready to use.

Sometimes, instruments are shipped with small accessory items in the same box. Check all items against the packing list before discarding the shipping container and packing material.

2-2 Location

Ultramite is a portable instrument which can be carried to any area of the plant or used on the lab bench.

It is operable over the ambient temperature limits of 0°C to 55°C. Ultramite has been designed to be used in the flat position or on its side and is position insensitive.

3-0 OPERATION

3-1 Start Up

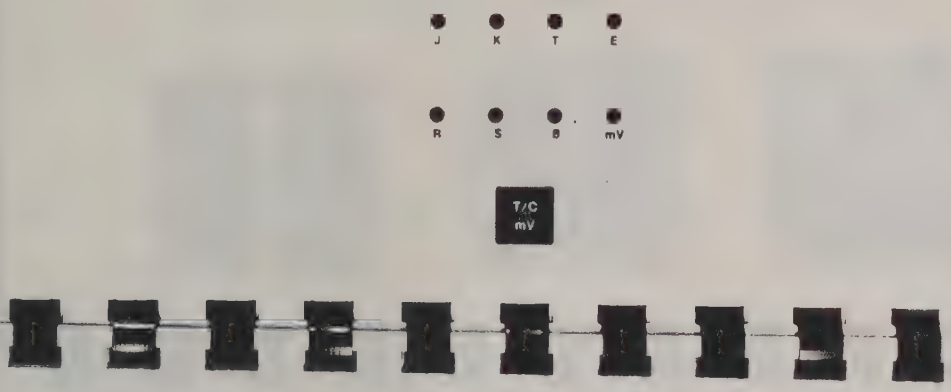
As you will see using Ultramite is extremely easy. To start up merely depress the On/Off membrane switch. The display will illuminate and you're ready to go. Upon start up you will be in the input mode, ready to read type J thermocouples in °F. In order to change to °C merely depress the °F °C membrane switch.

Standard Ultramite Display

High Resolution Ultramite Display

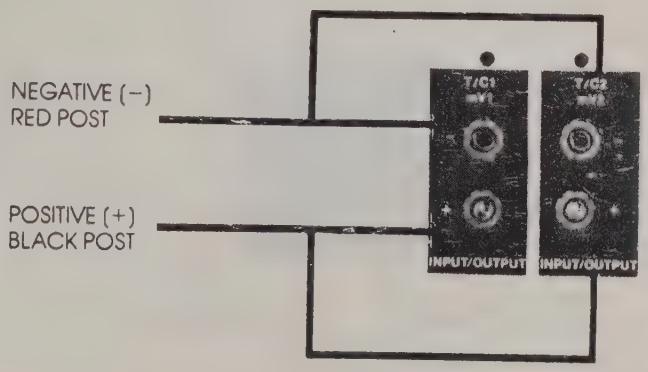
3-2 Thermocouple or Millivolt Selection

As stated above upon start up Ultramite will be in the input mode for type J thermocouples. You'll know this because the LED annunciator over type J will be illuminated. But what if you want to work with another thermocouple calibration or millivolts? Merely depress the TC/mV membrane switch. When you do you'll hear a "Beep" and Ultramite will switch consecutively to K, T, E, R, S, B, mV and back to J. Each time you depress the TC/mV switch Ultramite will shift the selection one position.



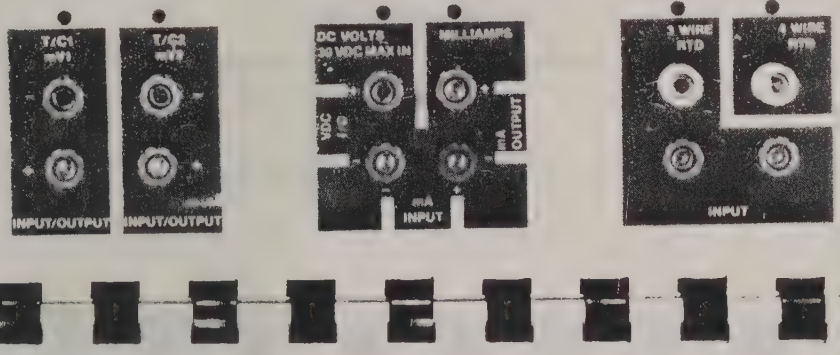
3-3 TC/mV Wiring

To input (or output) thermocouples merely attach the proper thermocouple calibration wire to either TC1 or TC2 binding posts. OBSERVE POLARITY!! In the thermocouple and mV positions red is the negative lead.



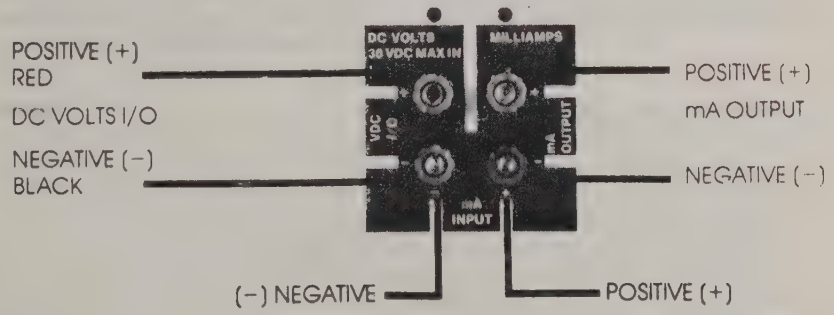
3-4 Operating Mode Selection

Selecting your operating mode from TC/mV, DC volts, milliamps, or 3 or 4 wire RTD's is simple. Upon start up the LED annunciator over TC1 will be illuminated. But, say you wish to input a 4 wire RTD. Merely depress the mode button. You'll hear a "Beep" and Ultramite will switch from TC1 to TC2. Depress it again and you'll switch to DC volts and so on until you reach 4 wire RTD. You'll be sure you're in the proper mode by the LED annunciator over each position. You'll also notice that the appropriate binding posts are located directly under the applicable LED. The following sections will detail how easy it is to "wire up" Ultramite.



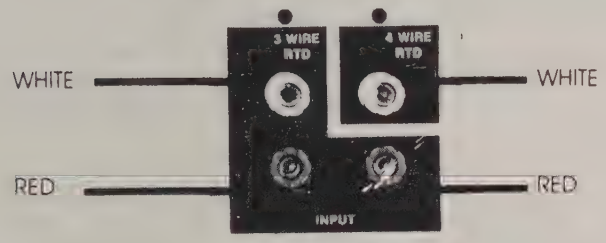
3-5 DC Volts/Milliamps

To input (or output) DC volts or milliamps you must wire Ultramite as shown below. Remember to observe polarity. In this case red is positive, the exact opposite of for thermocouples. VDC has input and output from the same terminals.



3-6 RTD Wiring

Ultramite follows the international color code for RTD's. In the 3 wire form this is red, red, white. In the 4 wire form it is red, red, white, white. Merely connect your RTD leads as shown below.



3-7 Outputs

Up to this point we have primarily described Ultramites input functions. However, Ultramite has extremely useful and unique output features. To enter the output mode merely depress either the ZERO or SPAN membrane switch. You'll hear a "Beep" and the LED annunciator will illuminate over the depressed switch. You are now in the output mode. Before proceeding to make adjustments you should check to see that you have selected the proper TC, mV or other function and that you are properly wired.

This done, you can proceed to make adjustments. For arguments sake let's say you've depressed the ZERO membrane switch and wish to output the equivalent of 0°F. By depressing (and holding in) the fast or slow increment △ or decrement ▽ switches you can drive the display to the desired value. You won't hear a "Beep" when you depress these switches. The fast membrane switches will drive Ultramites display (output) up or down rapidly. This is like the old style coarse potentiometers. The slow membrane switches perform the same function .1° at a time, like a fine potentiometer. When the desired value is attained, release the membrane switch and Ultramite is now outputting the displayed value.

3-9 Ultramite with 2 Wire 24 VDC Transmitters

Ultramite can be used to simultaneously provide power to 2 wire 24 VDC transmitters and read their output on the display. Utilize the following procedure: See Figure 1

1. Connect the positive terminal of the transmitter DC power input to the red binding post of Ultramites milliamp output terminals.
2. Connect the negative terminal of the transmitter to the black binding post of Ultramites milliamp output terminals.
3. Set Ultramite into the milliamp input mode.
4. Ultramite will now supply 24 VDC to the transmitter and display the transmitter output (current loop value) on the display.

4-0 OTHER FEATURES

4-1 The Display

Ultramite contains a unique .75" high LCD display which provides complete annunciation of operating modes. When working with temperature the display should indicate °F or °C. When working with milliamps Ultramite will display "A". To signify millivolts or DC voltage Ultramite will display "E". Additionally in the event of an overrange or underrange condition Ultramite will display "HI" or "LO" respectively. In the event of the batteries being too drained to continue Ultramite will display "HELP".

Ultramite's display is two position. When used in the flat position it is possible to "tilt" the display only forward for easy viewing. To do this depress the button on the side of the unit. The display will "pop" up. Pull the display panel to the front of the unit until it locks in place. To return the display to the flat position (this should always be done prior to putting the cover on), merely depress the button on the side of the case and press the display panel down until it clicks in place.

4-2 6 and 12 Point Thermocouple Modules

Ultramite has two switch modules available which can be used in the thermocouple input mode to increase the number of thermocouples which can be simultaneously wired to Ultramite. See Figure 8. To use either of these modules plug them into either the TC1 or TC2 terminals. Wire up the thermocouples to

5-3 Thermocouple input check:

1. Connect the output of the Ice Bath Reference to the T/C2 terminals of the Ultramite, as shown in figure 2.
2. Make sure that the Ultramite is in a stable temperature environment of about 25 deg C with no drafts or temperature variations. (if drafts exist shield instrument from air flow)
3. Depress the MODE button once so that the instrument is in the T/C2 mode of operation.
4. Allow at least 15 min. for the thermocouple connections to become stable.
5. Pick 5 temperature values between the limits of the instrument's range and with the aid of a thermocouple table note down the equivalent millivolt values
6. Using the above millivolt values adjust in turn the Precision Millivolt Standard to each value and note the corresponding reading on the display of the instrument.
7. Compare the readings obtained with the desired values and see if they are within the limits of error specified for the instrument.
8. Connect T/C2 terminals to Precision Millivolt Source as shown in Figure 3.
9. Depress T/CmV button until instrument is in the B thermocouple calibration.
10. Repeat steps 5 thru 7 to check accuracy in the B TC range.

11. This completes the basic accuracy check for the thermocouple and millivolt operation. The checking of these two ranges should be sufficient to insure proper calibration of the instrument. If there is another range that is suspect regarding calibration steps 1 thru 7 should be repeated using the proper Thermocouple ice leads for the range in question.

5-4 D.C. Voltage Input Calibration Check:

1. Connect Ultramite as shown in Figure 4.
2. Depress MODE button so that the instrument is in the D.C. voltage mode.
3. Adjust the Precision Voltage Standard for 5 values between 0 and 10 volts D.C. and note the readings displayed on the instrument.
4. Compare the displayed readings with the desired values and see if the instrument is within the given accuracy specifications.
5. This completes the D.C. voltage input calibration check.

5-5 D.C. Milliampere Input Calibration Check:

1. Connect Ultramite as shown in Figure 5.
2. Depress MODE button putting the instrument in the MILLIAMPS mode.
3. Adjust the Precision Current Standard for 5 values between 0 and 50.00 milliamps noting the displayed value at each point.

4. Compare displayed values against the desired values to see if the unit is within calibration accuracy.

5. This concludes D.C. milliamp input calibration check.

5-6 3 Wire RTD Calibration Check:

1. Connect Ultramite as shown in Figure 6.
2. Depress MODE button till unit is in 3 wire RTD mode.
3. Select 5 values between the limits of the RTD range. Look up the equivalent resistance values for the desired temperatures.
4. Adjust the Precision Resistance Standard to the above values and note the displayed values on the instrument.
5. Compare the values from the table to the values displayed and check if the difference is within calibration accuracy.
6. This concludes 3 wire RTD calibration check.

5-7 4 Wire RTD Calibration Check:

1. Connect Ultramite as shown in Figure 7.
2. Depress MODE button till unit is in 4 wire RTD mode.
3. Repeat steps 3 thru 5 of the 3 wire section.
4. This completes 4 wire RTD calibration check.

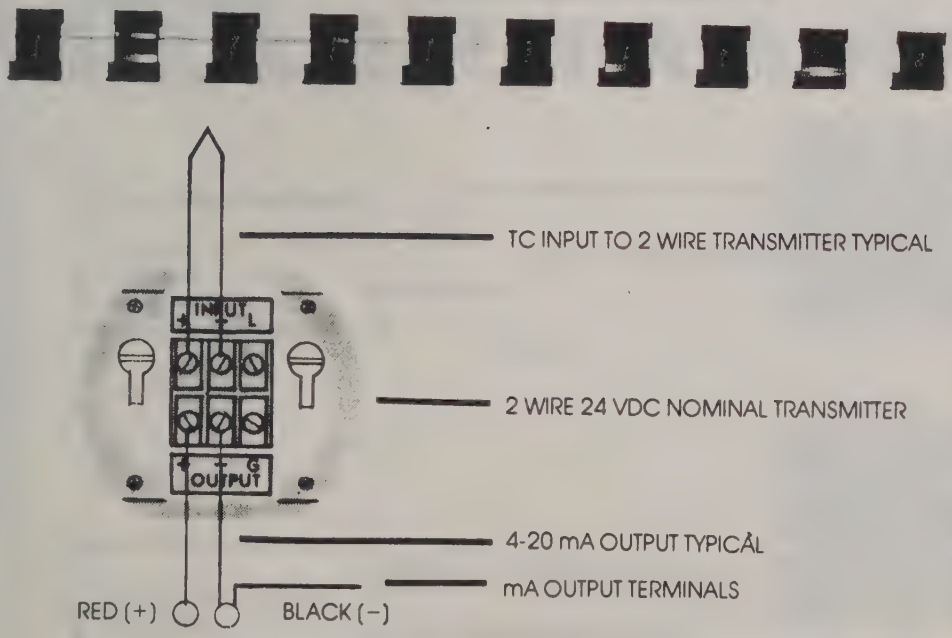


FIGURE 1

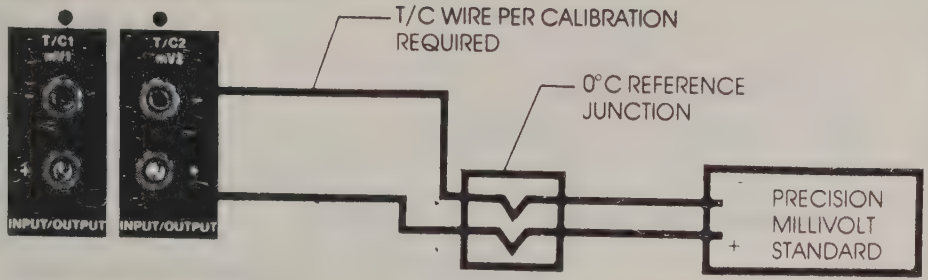


FIGURE 2

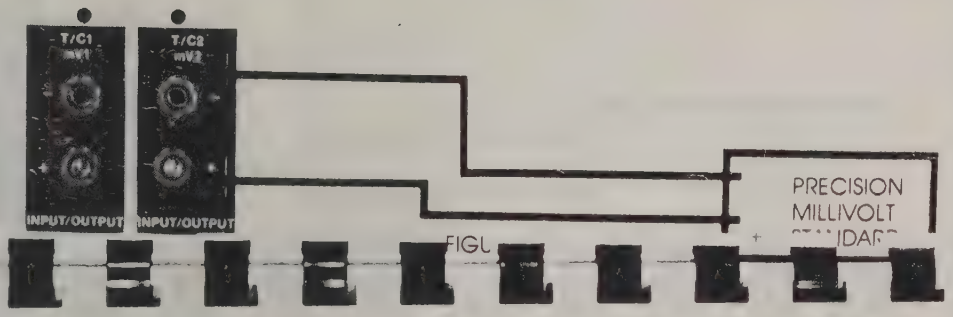


FIGURE 3

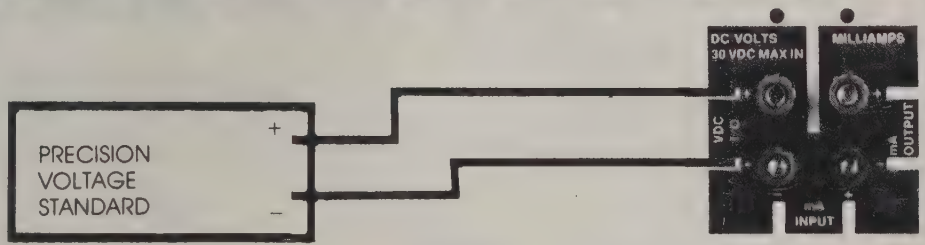


FIGURE 4

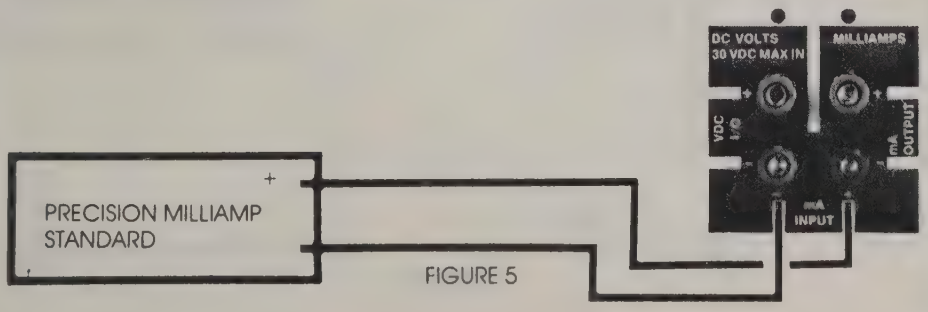


FIGURE 5

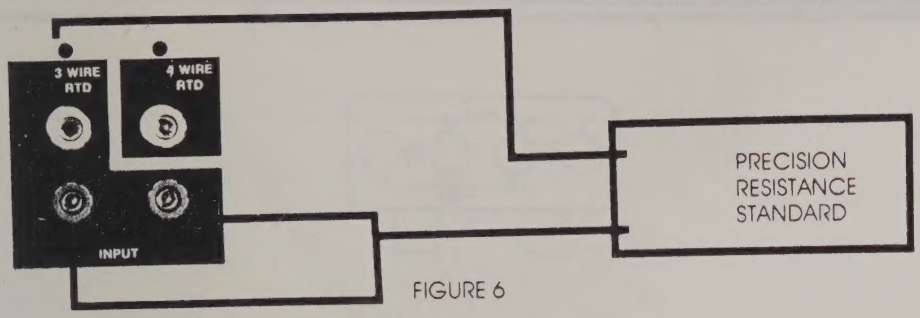


FIGURE 6

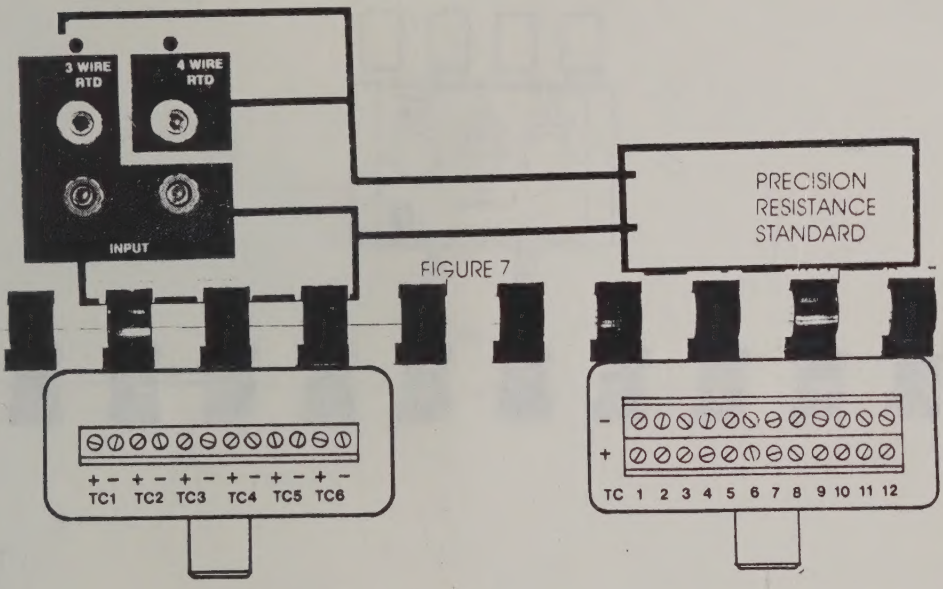


FIGURE 7

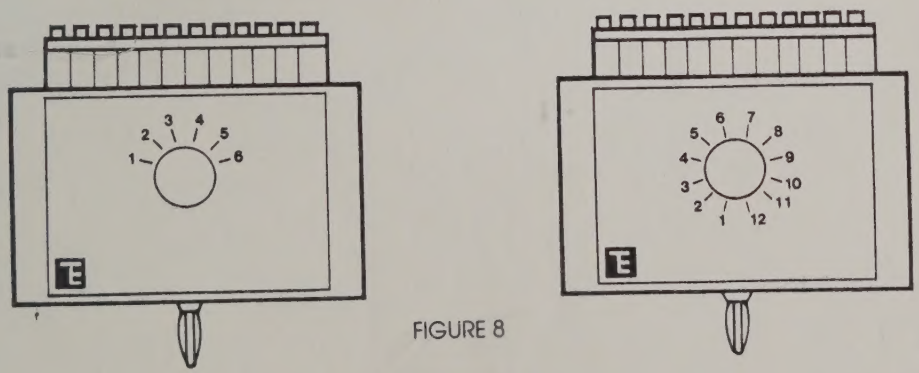
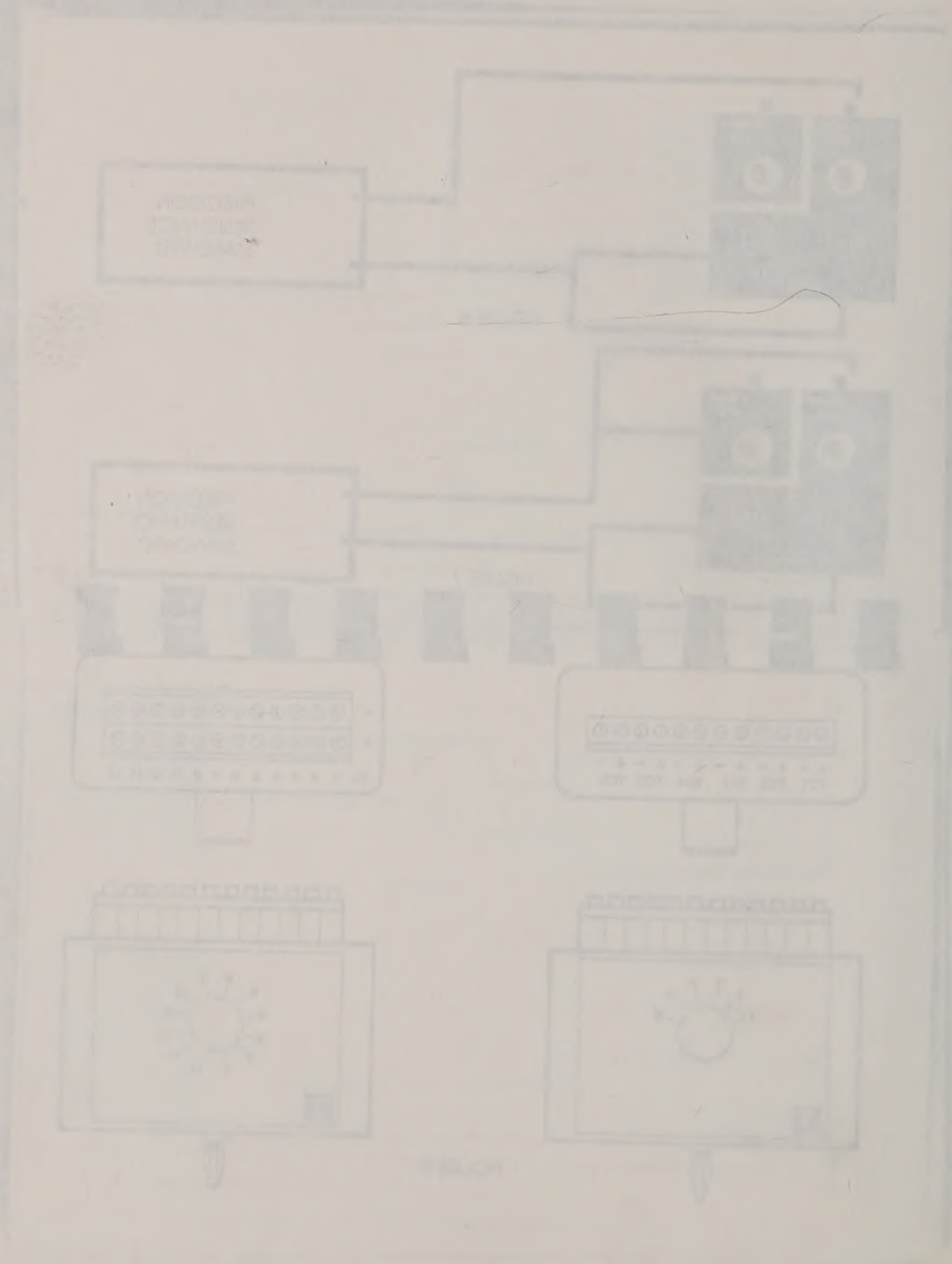
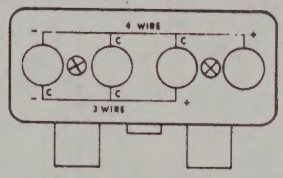


FIGURE 8




4 WIRE
C
C
C
C
3 WIRE

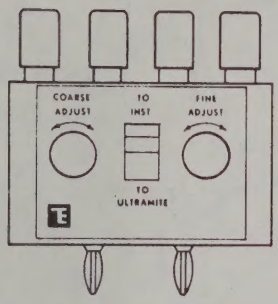

COARSE ADJUST
TO INST
FINE ADJUST
TO ULTRAMITE

FIGURE 9